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ICESat elevation profiles, inversion for ice shelf thickness

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The ice sheets fringing Antarctica can be investigated in detail with ICESat (Ice, Cloud, and land Elevation Satellite) altimetry data supported by MODIS imagery. ICESat's sensor, the Geoscience Laser Altimeter System (GLAS) has acquired elevation data sets during 2003-2005 with a measurement spacing of $\sim$172 m along track with a $\sim$70 m laser pulse footprint. ICESat can also repeat a track to about 50 meters cross-track spacing so that laser footprints overlap. The MODIS imagery allows features that are resolved by the ICESat data to be resolved spatially and specific features to be tracked along flow.

When skies are clear, ICESat can measure laser spot elevations with 2 to 3 centimeter precision over low slope ice sheet features such as the Ross Ice Shelf. Accuracies are currently at the several decimeter level but are improving through time. This greatly improved elevation data can be converted into ice shelf thickness by the equations summarized in Bamber and Bentley (1994). In addition, ICESat's periodic revisits of elevation profiles enables ice shelf thickness to be measured through time and this allows uncertain tide conditions to be compensated for. Unfortunately, clouds are common and relatively thick near the northern margin of the Ross and can degrade the available elevation data precision by more than a meter as well as reduce the number and density of retrieved elevations. Data obtained during ICESat's first five operational periods clearly documents the surface elevations of ice shelf features. ICESat data, combined with a mosaic of Antarctic MODIS imagery, will allow additional analysis of features of interest to be analyzed.